The statistics of the clear and cloudy days are given in Table 2, which presents, in addition, the number of days without any sunshine, or overcast days, *o*.

TABLE 2.—*Number of clear, cloudy, and overcast days, Apia, Samoa,* 1905–6.

Month.	1905.			1906.		
	s.	*c.*	*o.*	*s.*	*c.*	*o.*
January	6	10	3	8	6	1
February	3	10	3	5	9	1
March	7	11	4	8	10	5
April	8	9	4	11	5	2
May	14	5	1	6	8	2
June	8	5	2	4	9	3
July	7	9	1	6	5	2
August	6	9	1	5	9	2
September	9	4	0	17	4	0
October	15	3	0	11	6	2
November	7	10	4	8	9	4
December	3	10	2	2	11	3
Year	93	95	25	91	91	27
Average.						
Dry month	10	6	1	8	7	2
Wet month	6	10	3	7	8	3

The mean cloudiness has been derived according to the usual scale of 0 to 10 from the percentage of sunshine, *p*, using the formula

$$p+10\,d=100.$$

Thus, by the method of least squares, from the single monthly values of *s*, *c*, and *d* the following results for the coefficients *a* and *b* have been derived:

$$a=5.07,\ b=3.70.$$

It has been found that for Germany $a=5.1$ and $b=5.0$; therefore, the fluctuations of $c-s$, corresponding to certain fluctuations of *d*, are much larger in Samoa than they are in Germany.

The foot of Table 2 shows that in both years the average dry month embraced exactly as many clear days, as the average wet month embraced cloudy ones, and vice versa. Consequently in considering the annual amounts, the clear days appear as often as the cloudy ones, each being about 25 per cent of all days, i. e., exactly the percentage of degrees of sunshine embraced by the two classes according to their definition. This very even distribution of the different grades of cloudiness seems to be a remarkable feature of the climate of Samoa.

The annual number of days without any sunshine is about 26, or 7 per cent of all days. During the wet season the percentage is 10 and during the dry season only 4.

DAILY PERIOD.

In considering the average values for 1905–6 in the majority of the months the maximum sunshine occurs during the morning hours from 9^a–12^a, except the months of January (10^a–1^p), February (8^a–9^a), and May (12^a–1^p). The average maximum hour for the year as well as for the two seasons is from 10^a–11^a; this can be seen from Table 3.

TABLE 3.—*Average hourly percentages of sunshine, Apia, Samoa,* 1905–6.

Hours ending	Year.	Seasonal.	
		Dry.	Wet.
	%	%	%
7 a. m.	10(19)	6(19)	14(20)
8 a. m.	42	35	48
9 a. m.	57	58	57
10 a. m.	62	64	60
11 a. m.	63	65	62
12 m.	62	65	58
Sum, a. m.	**296**	**293**	**299**
1 p. m.	60	62	57
2 p. m.	54	58	51
3 p. m.	49	52	46
4 p. m.	42	46	38
5 p. m.	32	34	29
6 p. m.	9(18)	8(28)	10(14)
Sum, p. m.	**246**	**260**	**231**
Difference a. m.—p. m.	50	33	68

Regarding the figures for the hours ending 7 a. m. and 6 p. m., when compared with different months or seasons, or in comparison with the other hours of the day, it must be remembered that even on cloudless days the sunshine can be recorded only during a part of these hours. The maximum possible sunshine for these hours varies with the day's length from January (0.86 hour), June and July (0.12 hour), to December (0.90 hour). The average for the year is 0.50, for the dry months 0.29, and for the wet months 0.69 hour. When the mean cloudiness is to be computed from the hourly sunshine percentage, the figures for the two hours mentioned have to be divided by these fractions according to the different months of seasons. In Table 3 the figures thus obtained are added in curves. Thus during the wet season the sunshine of the early morning hours predominates a little over the dry season. Evidently during the wet months the higher altitude of the sun from 7 to 8 a. m. helps the sun to overcome the absorption produced by the lower strata, while in the dry season the sunshine predominates in the evening hours.

The diurnal maximum of sunshine is in accordance with the diurnal minimum of rain, which in Samoa occurs from 12 to 1 p. m. during the dry season, and during the wet season from 10 to 11 a. m. (quantity and intensity of rain), or 11 to 12 a. m. (duration of rain). Generally, the time of the diurnal rain minimum is a little later than the sunshine maximum. The total amount of forenoon sunshine of every month is greater than that of the afternoon. The months of May and June show a slight difference, but February and December more than one hour. The difference for the two seasons as well as for the year is given at the foot of the table, the average for the year is 0.50 hour.

THE SEASONS AND THE MEAN DAILY MINIMUM AT MEXICO, MO.

By GEORGE REEDER, Section Director. Dated Columbia, Mo., September 23, 1909.

It seems never to have been definitely determined upon what temperature the seasons depend, that is, at what temperature and corresponding date does spring open? When is the flood time of summer? the opening of autumn? the beginning of and the minimum cold of winter? Some writers[1] say that spring begins when the temperature reaches 44° F., but this does not seem to correspond to any distinct epoch in biological phenomena. As a rule, Nature's signs are well advanced before we begin to take notice of them. "The sap has begun to run," insect life is stirring, the brown sod is showing green, and then we say that spring is here. But the processes of life had already renewed their activity before these signs appeared; at just what time does that "mysterious touch of Nature" take place in the early spring?

A study of the mean annual or normal temperature of a place gives no satisfactory answer to this query, but the mean daily temperatures and particularly the mean daily minima present very interesting features. The present paper presents graphically in figs. 1 to 4, the results of the daily maximum and minimum temperatures recorded at Mexico, Audrain County, Mo., during the thirty years 1878 to 1907. A similar study and compilation for the seventeen years of records at Columbia, Boone County, Mo., gave results that agree in all essential points, but the daily irregularities are of course less marked in the means from the longer record at Mexico. The same figures present graphically the arithmetical sums of the rainfalls on each day for the whole thirty years.

In Missouri the seasons are particularly well marked, and both Mexico and Columbia afford very satisfactory points for

[1] Hann defines "winter days" as those days on which the temperature does not rise above freezing even in the afternoon, and "summer days" as those on which the afternoon temperature reaches or exceeds 25° C. (77° F.) (Hann-Ward: Climatology, p. 28). According to this definition, Mexico Mo., has but few winter days, if any.—*C. A., jr.*

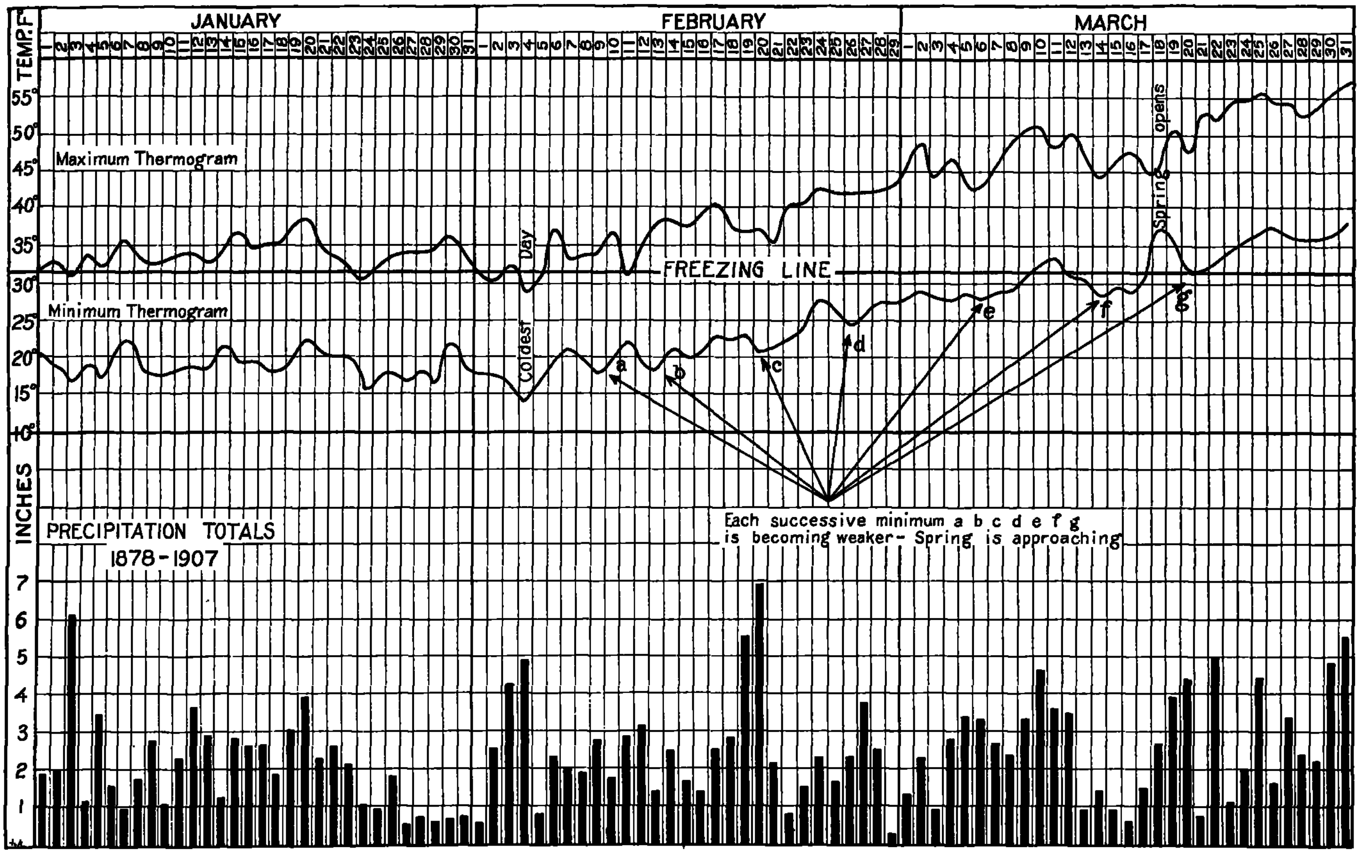

FIG. 1.—Average daily maximum and minimum temperatures, and daily precipitation totals, Mexico, Mo., 1878–1907. (January–March).

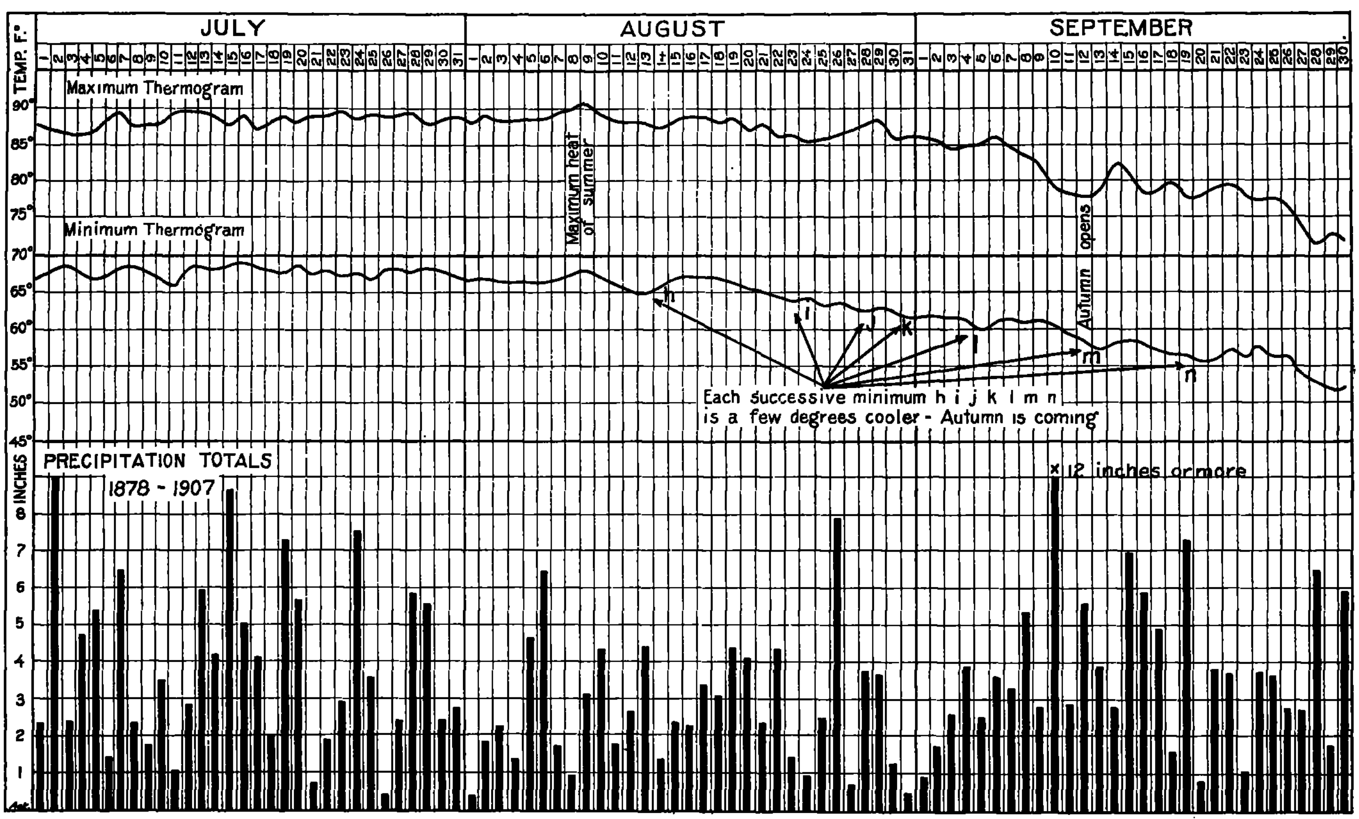

FIG. 3.—Average daily maximum and minimum temperatures, and daily precipitation totals, Mexico, Mo., 1878–1907. (July–August).

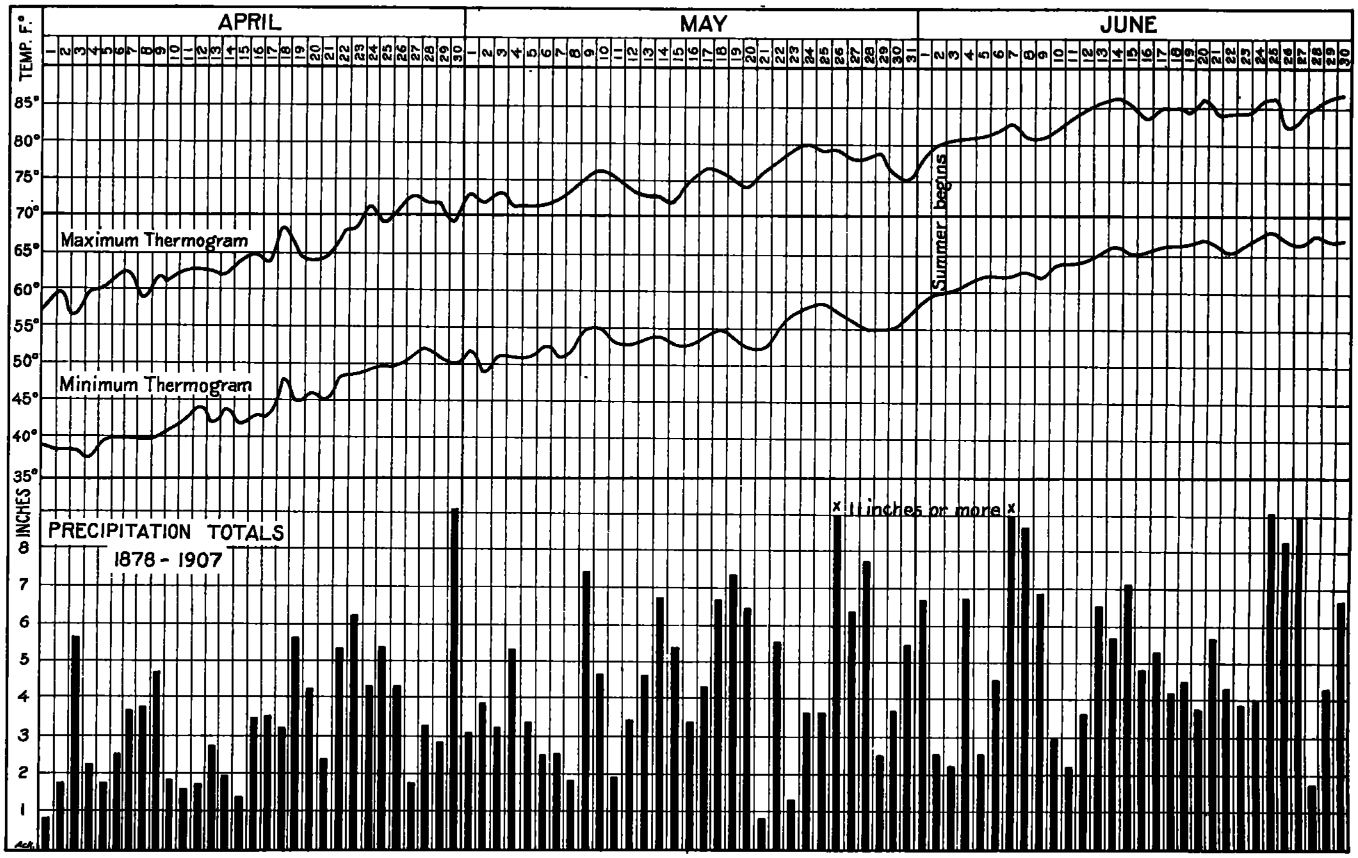

FIG. 2.—Average daily maximum and minimum temperatures, and daily precipitation totals, Mexico, Mo., 1878–1907. (April–June).

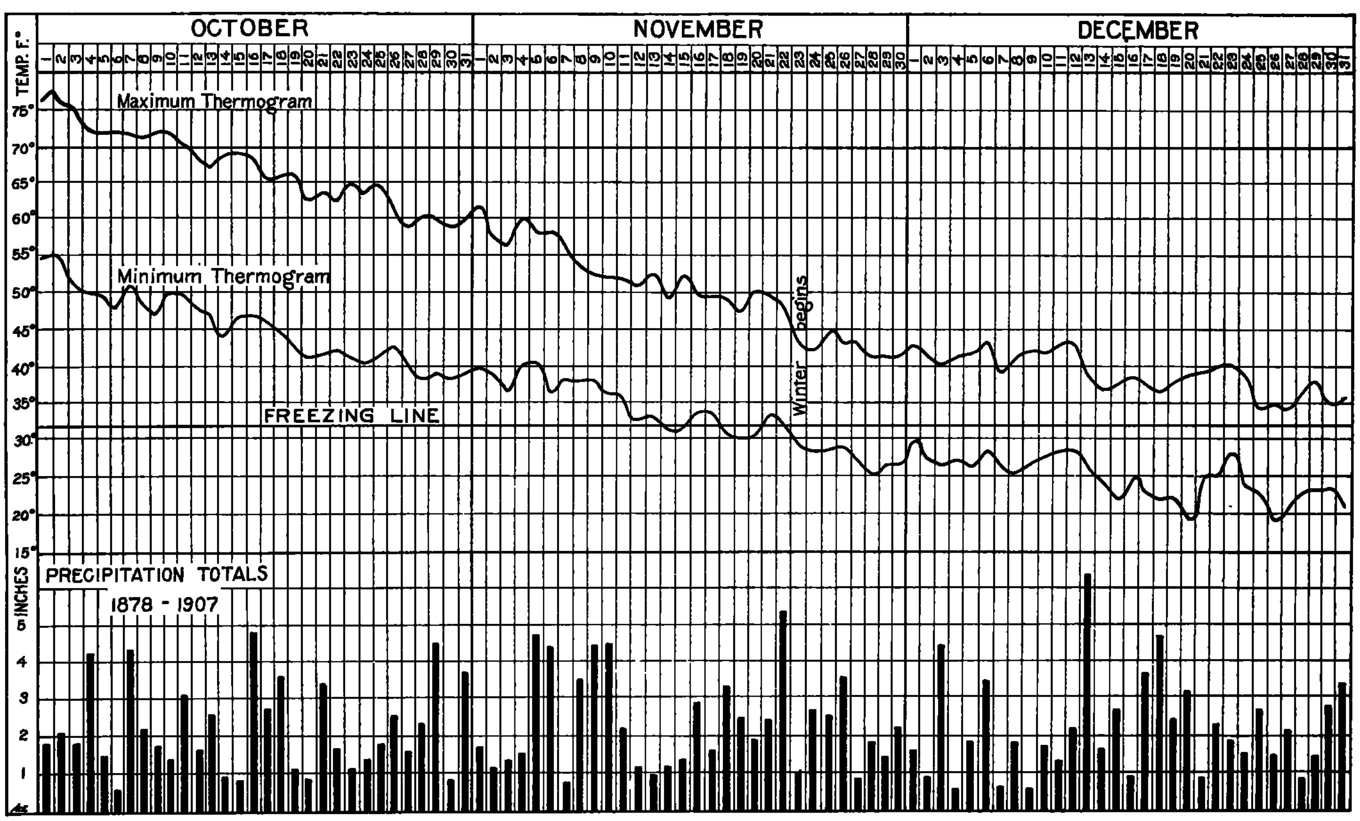

FIG. 4.—Average daily maximum and minimum temperatures, and daily precipitation totals, Mexico, Mo., 1878–1907. (October–December).

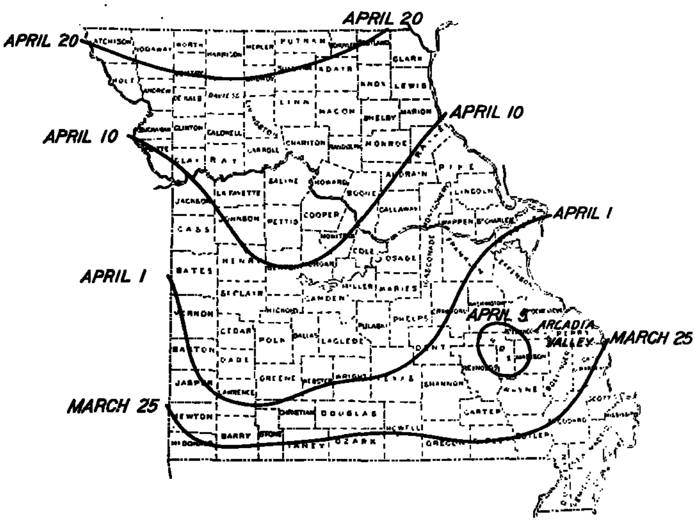

FIG. 5.—Average date of the first leafing of the soft maple in Missouri. (Four years, 1904-1907, observations).

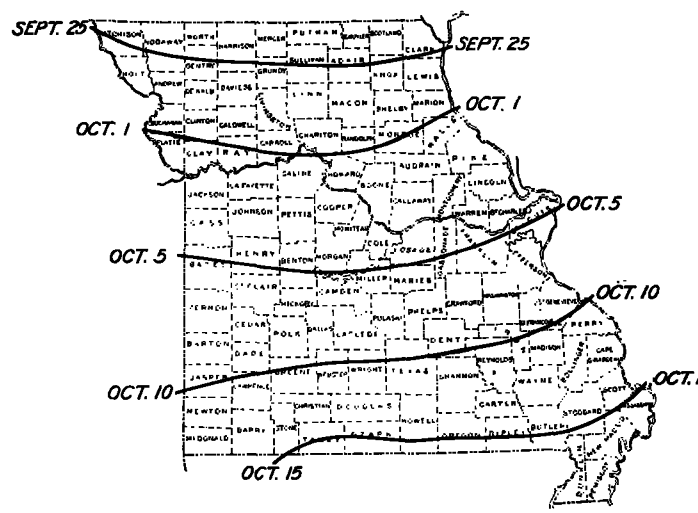

FIG. 6.—Average date on which the forests begin to assume autumn colors in Missouri. (Four years' observations).

observations which are calculated to develop the seasonal temperature fluctuations in the layers of the atmosphere and the earth which are nearest each other. One may observe that the thermograms of the average maximum and average minimum temperatures clearly indicate that for Mexico, Mo., the coldest day of winter is February 4. Immediately after that date both curves begin their ascent, indicating that the layers of earth and air in contact begin to receive more heat than they lose by radiation. Each successive drop in the minimum curve, occurring every four to six days, is a little weaker than the preceding one, for spring is approaching.

Is it possible for vegetal and insect life to awaken while the average daily minimum temperature remains below 32° F.? One may often experience a warm, spring-like day during the latter part of February and the first of March, but no insect seems to be stirring. Now we find that the curve of the average minimum first rises above 32° on March 10 (see fig. 1), but the writer does not believe that may be properly called the opening day of spring, for the curve continues below the freezing temperature line for a whole week longer. On the 18th, however, it finally rises and remains above the 32° line, and this date is evidently the opening day of spring, when that "first mysterious touch of Nature" takes place. While March 18 may mark the awakening, there is very little to indicate the phenomenon at this time, as all life seems yet dormant; but "the sap begins to run," and some time between April 8 and 12 the soft maple, which is an early variety, begins to put forth its first leaves. The progress across Missouri of this spring awakening of the soft maple is strikingly and clearly shown by the date lines of fig. 5.

The spring weather of Mexico, Mo., its many variations from warm to cool, sunshine to showers, is interestingly shown by fig. 2, which also shows the increasing stability of the weather as summer approaches. We have taken June 2 as the first day of summer because that is the first day on which the mean daily temperature reaches 70° and remains above it.

The astronomer informs us that the longest day of the northern [astronomical] summer is June 21, when the sun rises farthest in the north and sets farthest in the north. But it is generally known that the greatest heat of summer does not occur until some time after this date. The flood time of summer has never been, heretofore, definitely pointed out. Some observers have gone so far as to say that summer begins to wane in July, but this can not be true of Mexico, Mo., nor indeed of the central and greater portion of the United States. Summer can not wane before the maximum heat has been attained. About fifty days after the summer solstice, or the longest day of the northern year, i. e., about August 8 or 9, we reach the flood time of summer. The full flood of summer may be said to continue from July 15 to August 9, but it appears from fig. 3 that the maximum heat is attained on August 9 at Mexico, Mo. This figure shows clearly the steadily high temperatures from about July 15 to August 9, and that almost immediately following the latter date the ebb begins.

Both the maximum and the minimum thermograms, but more particularly the minimum, show clearly how the earth now begins to lose more heat by radiation than it received during the day. At each successive change the temperature curve drops a little lower than at the preceding change; the changes take place slowly for the first fifteen or twenty days, then the magnitude of the successive drops increases very noticeably. We plainly see "the signs of a dying year." And thus we approach the opening day of autumn, which I put at or about September 12 for the locality under discussion. Some fifteen or twenty days later we see the forests beginning to assume their autumn colors. As fig. 6 shows, this change is first noticed in the northern part of the State about September 20 and, reversing the direction of the march of the first leafing shown in fig. 5, sweeps slowly southward across the whole State, occupying about a month in its passage.

Our minimum thermogram, fig. 4, shows that winter begins at Mexico, Mo., on November 23, when the average daily minimum falls below 32° and stays there. Quite a month later the days are the shortest and the hours of darkness are the longest, but the winter cold does not reach its minimum until February 4, or about forty-five days after the winter solstice.

The curve of the average minimum temperatures shows that spring, as here defined, is made up of 77 days, summer of 101 days, autumn of 72 days, and winter of 115 days.

The total precipitation for the thirty years, 1878–1907, is shown day by day in figs. 1 to 4, which bring out clearly the rainfall of the different periods, the increase from winter to spring and summer, and the decrease to autumn again. The days of the years which have the heaviest rainfalls or are most frequently rainy are readily picked out since they have the tallest columns, i. e., have the greatest totals for the whole thirty years.

ICE CONDITIONS ON THE GREAT LAKES, WINTER OF 1908-09.[1]

By N. B. CONGER, Inspector and Marine Agent. Dated Detroit, Mich., July 14, 1909.

On account of the comparatively mild winter in the Lake region there was less ice reported in all of the lakes. The

[1]Similar details as to ice in the Great Lakes for the winters of 1899–1907 will be found in the Lake Charts for those years, published semiannually by the Weather Bureau, also in Monthly Weather Review, August, 1908, 36:239–244, and May, 1908, 36:137–140.